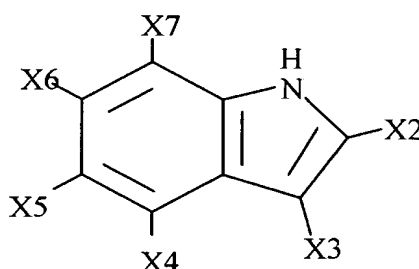


**Claims:**

1. A catalyst system comprising:  
one or more polymerization catalysts; and  
an activator comprising one or more heterocyclic nitrogen-containing ligands coordinated to a Group 13 atom, wherein the activator is a reaction product of one or more alkyl substituted Group 13 atom-containing compounds and one or more heterocyclic nitrogen-containing compounds, the one or more heterocyclic nitrogen-containing ligands represented by:



wherein each substituent X2, X3, X4, X5, X6, and X7 is independently selected from the group consisting of hydrogen, chlorine, fluorine, iodine, and bromine.

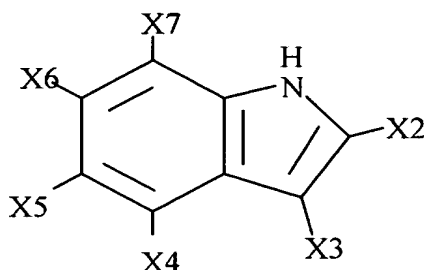
2. The catalyst system of claim 1, wherein X4 is chlorine, fluorine, iodine, or bromine and X2, X3, X5, X6, and X7 are hydrogen.
3. The catalyst system of claim 1, wherein X5 is chlorine, fluorine, iodine, or bromine and X2, X3, X4, X6, and X7 are hydrogen.
4. The catalyst system of claim 1, wherein X6 is chlorine, fluorine, iodine, or bromine and X2, X3, X4, X5, and X7 are hydrogen.
5. The catalyst system of claim 1, wherein both X4 and X5 is chlorine, fluorine, iodine, or bromine and X2, X3, X6, and X7 are hydrogen.

PATENT

Attorney Docket No.: 2002U038 (UNIV/0014)

Express Mail No.: EV 351031305 US

6. The catalyst system of claim 1, wherein both X5 and X6 are chlorine, fluorine, iodine, or bromine, and X2, X3, X4 and X7 are hydrogen.
7. The catalyst system of claim 1, wherein the polymerization catalyst comprises one or more metallocenes, Group 15-containing compounds, phenoxide transition metal compositions, Group 5 or 6 metal imido complexes, bridged bis(arylamido) Group 4 compounds, derivatives thereof, or combinations thereof.
8. The catalyst system of claim 1, wherein the Group 13 atom is aluminum.
9. The catalyst system of claim 1, wherein the Group 13 atom is boron.
10. The catalyst system of claim 1, further comprising a support material.
11. The catalyst system of claim 1, further comprising a support material that comprises silica.
12. The catalyst system of claim 1, further comprising a support material treated with aluminoxane or an alkyl aluminum compound such that the support comprises aluminum alkyls groups bonded thereto.
13. A catalyst system comprising:
  - one or more polymerization catalysts; and
  - an activator comprising one or more heterocyclic nitrogen-containing ligands coordinated to an aluminum atom, wherein the activator is a reaction product of one or more alkyl substituted aluminum-containing compounds and one or more heterocyclic nitrogen-containing compounds, the one or more heterocyclic nitrogen-containing ligands represented by:



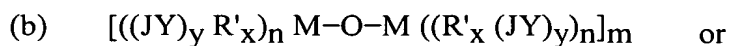
wherein each substituent X2, X3, X4, X5, X6, and X7 is independently selected from the group consisting of hydrogen, chlorine, fluorine, iodine, and bromine.

14. The catalyst system of claim 13, wherein each substituent X2, X3, X4 and X7 is hydrogen and X5 and X6 are independently selected from the group consisting of hydrogen, chlorine, fluorine, iodine, and bromine

15. The catalyst system of claim 13, further comprising a support material treated with aluminoxane or an alkyl aluminum compound such that the support comprises aluminum alkyls groups bonded thereto.

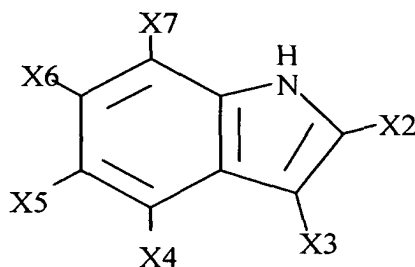
16. The catalyst system of claim 13, wherein the polymerization catalyst comprises one or more metallocenes, Group 15-containing compounds, phenoxide transition metal compositions, Group 5 or 6 metal imido complexes, bridged bis(arylamido) Group 4 compounds, derivatives thereof, or combinations thereof.

17. A catalyst system comprising:  
 one or more polymerization catalysts;  
 at least one activator; and  
 a support material treated with aluminoxane or an alkyl aluminum compound such that the support comprises aluminum alkyls groups bonded thereto;  
 wherein the activator is represented by one of the following formulas:





wherein M is aluminum, O is oxygen, and (JY) is a heterocyclic nitrogen-containing ligand represented by:



wherein each substituent X2, X3, X4, X5, X6, and X7 is independently selected from the group consisting of hydrogen, chlorine, fluorine, iodine, and bromine;

wherein n is 1 or 2 in formula (a); n is 2 in formula (b); and n is an number from 1 to 1,000 in formula (c);

wherein m is a number from 1 to 10;

wherein  $x + y =$  the valence of M in formula (a);  $x + y =$  the valence of M - 1 in formula (b); and  $x + y =$  valence of M - 2 in formula (c); and

wherein each R' is a substituent group bonded to M.

18. The catalyst system of claim 17, wherein each R' is independently selected from the group consisting of hydrogen, linear or branched alkyl radicals, linear or branched alkenyl radicals, linear or branched alkynyl radicals, cycloalkyl radicals, aryl radicals, acyl radicals, aroyl radicals, alkoxy radicals, aryloxy radicals, alkylthio radicals, dialkylamino radicals, alkoxycarbonyl radicals, aryloxycarbonyl radicals, carbomoyl radicals, alkyl radicals, dialkyl radicals, carbamoyl radicals, acyloxy radicals, acylamino radicals, aroylamino radicals, straight alkylene radicals, branched alkylene radicals, cyclic alkylene radicals, derivatives thereof, and combinations thereof.

19. The catalyst system of claim 17, wherein each R' is bonded to the support material and is independently selected from the group consisting of hydrogen, linear or branched alkyl

PATENT

Attorney Docket No.: 2002U038 (UNIV/0014)

Express Mail No.: EV 351031305 US

radicals, linear or branched alkenyl radicals, linear or branched alkynyl radicals, cycloalkyl radicals, aryl radicals, acyl radicals, aroyl radicals, alkoxy radicals, aryloxy radicals, alkylthio radicals, dialkylamino radicals, alkoxycarbonyl radicals, aryloxycarbonyl radicals, carbomoyl radicals, alkyl radicals, dialkyl radicals, carbamoyl radicals, acyloxy radicals, acylamino radicals, aroylamino radicals, straight alkylene radicals, branched alkylene radicals, cyclic alkylene radicals, derivatives thereof, and combinations thereof.

20. The catalyst system of claim 17, wherein each substituent X2, X3, X4 and X7 is hydrogen, and X5 and X6 are independently selected from the group consisting of hydrogen, chlorine, fluorine, iodine, and bromine

21. The catalyst system of claim 1, wherein the heterocyclic nitrogen-containing ligand is selected from the group consisting of 4-bromoindole, 4-chloroindole, 4-fluoroindole, 5-bromoindole, 5-chloroindole, 5-fluoroindole, 4,5,6,7-tetrafluoroindole, 2-methylindole, and 3-methylindole.

22. A polymer produced using the catalyst system of claim 1.

23. A polymerization process utilizing the catalyst system of claim 17.

24. A polymer produced utilizing the catalyst system of claim 17.